DOCUMENT RESUME

ED 221 725 CE 033 904

AUTHOR Pribyl, Paul F.
TITLE Ladders. Fire Service Certification Series. Unit FSCS-FF-7-80.
INSTITUTION Wisconsin State Board of Vocational, Technical, and Adult Education, Madison. Bureau of Program Development and Operations.
PUB DATE 80
NOTE 28p.; For related documents, see CE 033 897-915.
AVAILABLE FROM Wisconsin Board of Vocational, Technical and Adult Education, P.O. Box 7874, 4802 Sheboygan Avenue, 7th Fl., Madison, WI 53707 (Free to educational agencies).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Behavioral Objectives; Course Descriptions; *Equipment Utilization; *Fire Fighters; *Fire Protection; *Fire Science Education; Learning Activities; Lesson Plans; Postsecondary Education; Teaching Guides; Units of Study
IDENTIFIERS *Ladders (Equipment); Wisconsin

ABSTRACT

This training unit on ladders is part of a 17-unit course package written to aid instructors in the development, teaching, and evaluation of fire fighters in the Wisconsin Fire Service Certification Series. The purpose stated for the 20-hour unit is to make the fire fighter capable of doing routine work with hand-operated ground ladders. An instructor's guide sheet provides this information: introduction to the topic, instructor preparation, length of unit, methods of instruction, testing, equipment and facilities required, recommended visual aids, and references. Following a list of unit objectives, a lesson plan outlines the main teaching points and states the preferred teaching method, cites the reference and page number(s) where the information is to be found, and indicates the necessary handouts. Other contents in the unit include a unit quiz, answer key to the quiz, and handouts (graphs, student worksheets, informational material, and forms). (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED221725

WISCONSIN BOARD OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION
4802 Sheboygan Avenue, Madison, Wisconsin 53702
Robert P. Sorensen, Ph.D., State Director

FIRE SERVICE CERTIFICATION SERIES

UNIT FSCS-FF-7-80

LADDERS

FIRE SERVICE TRAINING

Simon L. Hertzler
Vocational Education Consultant

Paul F. Pribyl
Vocational Education Consultant

BUREAU OF PROGRAM DEVELOPMENT

George R. Kinsler
Bureau Director

Arnold H. Potthast
Chief Supervisor
Vocational Education

CE033904

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

P Pribyl

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CONTENTS

	PAGE
INTRODUCTION	1
INSTRUCTOR GUIDE SHEETS	2
OBJECTIVES	3-4
LESSON PLANS	5-17
UNIT QUIZ	18-19
ANSWER KEY	20
APPENDIX	
HANDOUT MATERIALS	21-25

LADDERS

Prepared by:

Paul F. Pribyl, Consultant
Fire Service Training

INTRODUCTION

The purpose of this unit is to make the firefighter capable of doing routine work with hand-operated ground ladders. During this unit, the instructor should assist the candidate in becoming reasonably proficient in the areas of climbing, carries, raises and securing hand-operated ground ladders.

It is important that the candidates understand the importance of teamwork to insure smooth operations while using ground ladders. The candidates should be proficient in doing routine work with ground ladders that will be expected of them.

The general requirements of the fire service for adequate manually-operated ground ladders are similiar in most communities. The number of ladder apparatus and the amount of ladders carried by other fire companies may vary. Fire service graound ladders are necessary to perform rescue, reach upper portions of a structure, and provide a means for directinf fire streams from elevated positions. Building code requirements for enclosed exit facilities have made buildings safer, but there is still the same need for ground ladders. Although power-operated aerial ladders and elevating platforms provide a means of rescue from floors beyond the reach of ground ladders, the shorter manually-operated ladders are sometimes more adaptable to rescue procedures from lower floors.

INSTRUCTOR PREPARATION

Carefully study the objectives to determine the goals that have been set for the fire fighters upon completion of this unit.

Review the lesson plans and if necessary consult the references listed.

Develop suitable audio-visual aids, provide training area and necessary tools and equipmen to teach this unit.

LENGTH OF UNIT

Classroom Work	1 hour and 30 minutes
Practical Skills Training	17 hours
Evaluation and Testing	1 hour and 30 minutes

METHODS OF INSTRUCTION

Lecture/Illustrated/Demonstration Method

Suggested methods and techniques are listed under Instructor's Notes on the lesson plans. For further information consult Fire Service Instructor Training, IFSTA #303, 3rd ed., pp. 71-83.

TESTING

At the end of this unit, a written quiz of five or more questions will be given.

EQUIPMENT AND FACILITIES REQUIRED

Classroom with necessary audio-visual equipment
Area where largest ladder can be extended.
Rope for securing ladders
6 rope hose tools or spanner belts
Pompier belt if available
Assorted ladders
Pumper with ladders
Aerial Ladder, if available
Suggested viual, "Ground Ladders" film available from NFPA Boston MA. 02110

REFERENCES

1. Hudiburg, E. and Thomas, C. Ed., Fire Service Ground Ladder Practices, 7th ed., #102 IFSTA, Stillwater, 1973, pp. 3-111

2. Hudiburg, E., Nad McCoy, C, Ed., Fire Service Practices for Volunteer Fire Departments, 5th ed., #201, IFSTA, Stillwater, 1971, pp. 59-71

3. Fire Service Training Committee of the National Fire Protection Association, Ed., Handling Hose and Ladders, National Fire Protection Association, Boston, 1969, pp. 62-135

4. Paige, J., Ed., Essentials of Fire Fighting, 1st ed., #200, IFSTA, Stillwater, 1977, pp. 37-95

OBJECTIVES

All objectives in this unit are to be met according to the material contained in the International Fire Service Training Association Manuals #102 Fire Service Ground Ladder Practices, #201, Fire Service Practices for Volunteer Fire Departments, #200 Essentials of Fire Fighting.

To statisfactorily complete this unit, the firefighter must attain a grade of 70 or higher on the written quiz and successfully complete the practical skills examination.

NFPA STANDARD 1001

LADDERS

FIRE FIGHTER I

3-9 Ladders

3-9.1 The fire fighter shall identify all ladders specified by the authority having jurisdiction, and their uses.

3-9.2 The fire fighter, operating as an individual and as a member of a team, shall demonstrate the following ladder carries, the method of carry being specified by the authority having jurisdiction, (a) one person carry, (b) two person carry, (c) three person carry, (d) four person carry, (e) five person carry, (f) six person carry.

3-9.3 The fire fighter, operating as an individual and as a member of a team, shall raise every type and size of ground ladder as specified by the authority having jurisdiction; and use several different raises for each ladder.

3-9.4 The fire fighter shall correctly climb the full length of every type of ground and aerial ladder, specified by the authority having jurisdiction.

3-9.5 The fire fighter shall correctly climb the full length of every type of ground and aerial ladder, as specified by the authority having jurisdiction, carrying fire fighting tools or equipment while ascending and descending the ladder.

3-9.6 The fire fighter shall correctly climb the full length of every type of ground and aerial ladder as specified by the authority having jurisdiction, and bring an "injured person" down the ladder.

OBJECTIVES

NFPA STANDARD 1001

LADDERS

FIRE FIGHTER I

3-9 Ladders

3-9.7 The fire fighter shall demonstrate the methods of working from ground or aerial ladders with tools and appliances, and with or without a life belt, as specified by the authority having jurisdiction.

3-9.8 The fire fighter shall demonstrate the proper procedure for cleaning ladders.

FIRE FIGHTER II

4-9 Ladders

4-9.1 The fire fighter shall identify the materials used in ladder construction.

4-9.2 The fire fighter shall identify the load safety features of a-1 ground and aerial ladders used by the authority having jurisdiction.

4-9.3 The fire fighter shall demonstrate inspection, care, and maintenance procedures for all different types of graound and aerial ladders, used by the authority having jurisdiction.

COURSE: FIRE SERVICE CERTIFICATION SERIES

LESSON: LADDERS

EQUIPMENT NEEDED: SLIDE, OVERHEAD OR MOVIE PROJECTORS, SCREEN

TRAINING AIDS: SLIDES, TRANSPARENCIES, FILMS, TEXTS

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Essentials of Fire Fighting #200 IFSTA 1st ed., pp. 37-39 This would also be a good place in the instructional pattern to utilize the NFPA film "ground Ladders" Objectives 3-9.2 3-9.3 3-9.4 3-9.5 3-9.6 3-9.7 Are all covered in the practical skills testing portion of this course.	I. Basic Ladder Information A. Purpose of fire service ladders 1. Save lives 2. Extinguish fires 3. Gain access to elevated areas B. Ladder Terms Fire fighters should become familiar with the generally-accepted terms used. To help the fire fighter identify and use these terms, the following explanations are offered to help make ladder terms more easily understood. 1. Anchor - That part of the ladder which is used to attach the halyard to the ladder 2. Beam - One of two principal structural sides of a ladder 3. Beam Bolts - Bolts which pass through both rails at a truss block of a wood ladder 4. Bed - The lower section of an extension ladder 5. Braces/Strutts - Diagonal members between the rails and blocks 6. Butt - Another term for the heel of the ladder 7. Dogs - Another term for ladder lock 8. Extension Ladder - A term to identify a ladder with two or more sections 9. Fly - The upper section or top sections of an extension ladder

INSTRUCTORS NOTES

TEACHING POINTS

I. B. Ladder Terms

10. Ground Ladder - A descriptive term to designate the difference between ladders raised on the ground and those raised from the apparatus

11. Guides - Wood or metal strips on an extension ladder which guide the fly section while being raised. (sometimes in the form of slots or channels)

12. Halyard - A rope used for hoisting fly section

13. Heel - The bottom or ground end of a ladder

14. Heal Plates - Metal safety plates attached to the heel of a ground ladder to stabilize the ladder and protect the beam

15. Hooks - Curved, sharp metal device (two in number) which folds outward from each beam at the top end of a roof ladder

16. Lock - Metal devices used to hold the fly section in place after it has been extended

17. Pawl - Another term for a ladder lock

18. Protection Plates - Plates fastened to a ladder to prevent wear at ponts where it comes in contact with mounting brackets

19. Pulley - A small grooved wheel through which the halyard is drawn

20. Rails - The two lengthwise members of a trussed ladder beam which are separated by truss or separation blocks

21. Rungs - Cross members (usually round) between the beams on which people climb

22. Safety Shoes - Rubber or neoprene spike plates usually of the swivel type, attached to the heel of a ground ladder

23. Spurs - Metal points at the lower end of tormentor poles

24. Staypole - Another term for tormentor

INSTRUCTORS NOTES

TEACHING POINTS

I. B. Ladder Terms

25. Stops - Wood or metal pieces which prevent the fly section from being extended too far

Ref; Essentials of Fire Fighting, 1st ed., IFSTA #200 pp. 39-40

3-9.1

C. Ladder Types

1. Straight Ladder

a. nonadjustable in length - one section

b. size designated by overall length of side rails generally 12 - 14 - 16 - 18 and 24 feet although longer straight ladders do exist

c. sometimes called a "wall ladder"

d. straight ladders must be constructed to have a maximum strength and minimum weight and may be of the trussed type to reduce their weight.

2. Extension Ladder

a. adjustable in length - consists of two or more sections which travel in guides or bracket to permit length adjustments.

b. size designated by the lengths of the sections measured along the side rails when fully extended. Range from 24-55 feet in length.

c. Most of longer extension ladders - truss type and are usually equipped with stabilizing poles called tormentors.

d. heavier than straight ladders - require more personnel for raising

e. Baby Extension (Baby Bangor)

(1) 12 foot long extension ladder without a halyard to raise the fly section - hand-raised fly is held in position by engaging its heel spurs over the upper rungs of the main section

INSTRUCTORS NOTES

TEACHING POINTS

Ref: Esstential of Fire Fighting, 1st ed., IFSTA pp 40

3-9.1

C. Ladder Types

3. Combination Ladders

a. is adjustable in length and the sections can be unlocked to form a step ladder or "A" frame ladder.

b. size designated by length of sections

4. Roof Ladders

a. designed for one specific purpose - can be and has been used for other purposes

b. equipped with folding hooks which fasten over roof ridge or other parts with the ladder laying flat on roof

c. range from 12 to 20 feet in size

5. Folding Ladders

a. used for reaching through openings into attics and lofts

b. constructed so that they can be folded or collapsed for small room or closet work

c. generally short in length as they are only used to recah short distances

6. Aerial Ladders

a. mechanical unit generally operated by hydraulic power - mounted upon a specially built chassis

b. currently constructed of metal, trussed to provide adequate strength usually 65 to 100 feet in length although longer ladders do exist

7. Tower Ladder

a. A telescoping boom with a ladder mounted on it with apartially enclosed platform at the end of the tower.

INSTRUCTORS NOTES

TEACHING POINTS

C. Ladder Types

8. Elevating Platforms

a. Although elevating platforms are not considered ladders some do carry ground ladders

b. Primarly a portable elevator controlled by the operator

c. range from 50 - 135 feet in height with some larger units being contsructed

9. Pompier Ladder

3-9.1

a. single beam through which the rungs project with a gooseneck hook on end

b. used to rescue persons beyond the reach of ground or aerial ladders

c. seldom used or carried today

pp. 40-41

D. Design and Construction

4-9.1

Although present national specifications for fire service ground ladders recommend that they should be made of metal, wood-constructed ladders can be supplied by some manufacturers. A plastic lamination of fiberglass materials can also be used in the construction of ladders.

1. Aluminum Alloy Ladders

Metal fire service ground ladders are usually built with heat-treated aluminum alloy. The principal reasons for using aluminum are:

a. it is light in weight

b. has adequate strength

c. permits a relisble visual inspection of all ladder parts

d. aluminum ladders require less maintenance than wooden ladders

e. aluminum ladders are eesy to keep clean

There are some disadvantages to aluminum ladders

INSTRUCTORS NOTES

TEACHING POINTS

D. Design and Construction

a. aluminum is a good conductor of electricity

CAUTION MUST BE USED WHENEVER METAL LADDERS ARE USED NEAR ELECTRICAL POWER SOURCES

b. increased possibility of freezing to the ladder in extremely cold weather.

Aluminum can become very cold in winter and noticeable hot in summer because of its good conductive qualities.

2. Steel Alloy Ladders

a. not practical for manufacture of manually-operated ground ladders

b. sometimes used in the manufacture of powered ladders

3. Wood Ladders

a. relatively few manufactured today but many are still in service

b. wood shrinks upon exposusre to low humidity and artificial heat - a coomon occurence at fires.

c. some ladders being manufactured as composites of wood and aluminum to take advantage of lightness and strength and resistance to electricity. These ladders have wood rails and aluminum rungs.

4. Ladders of Other Materials

a. Fiber glass and plastic ladders being used by power companies due to their non-conducting characteristics.

b. not popular with fire departments because of temperature resistant and rigidity factors

c. fire ladders with extruded fiberglass rails and aluminum rungs are being manufactured to comply with NFPA 1931 specifications for ground ladders.

INSTRUCTORS NOTES	TEACHING POINTS
p. 41	D. Design and Construction 5. Truss Construction in Ladders a. Means to support, strengthen, or stiffen as a beam b. principle of a truss is applicable to manually-operated ground ladders c. truss assembly of metal ladder is usually framed between two parallel rails, where the trength of the truss is dependent on the strength of the metal d. wood truss beams also have two rail members with beams separated and held secure by wood separation blocks. e. when the truss rail of a wood ladder is placed toward the building with the top end supported, the truss rail is under tension. f. the curvature of the truss rail, as it forms the truss, increases the tensile strength of the ladder.
3-9.8 4-9.3	E. Cleaning and Inspecting Ground Ladders a. Remove dirt with a brush and running water b. Use solvent cleaners to remove any oily or greasy residues c. after rinsing or anytime a ladder is wet, wipe it dry d. watch for defects in ladder or damaged parts e. if a part shows excessive wear determine cause f. all braces, slides, stops, locks, halyards, rivets, pulleys and other moveable parts should however be examined. The moveable parts should be lubricated at least every six months with a water-proof grease. Removing old grease with a solvent g. check wood ladders for cracks and splinters h. Check wood rungs at point they come into contact with ladder locks

INSTRUCTORS NOTES

TEACHING POINTS

E. Cleaning and Inspecting Ground Ladders

i. check rungs for tightness

j. check bolts, rivets and welds for looseness

k. check beams. trusses and truss blocks for evidence of compression failure

Ref: Essentials of Fire Fighting, 1st ed., IFSTA pp. 44-46

F. Selecting The Ladder For The Job

The designated length of ground ladders is derived from a measurement on the basis of their maximum useable length.

These lengths have been established according to the places where they will normally reach:

a. 50 foot extension - normally to the 4th floor windows - under some circumstances the roof of a four story building

b. 35 foot extension - the most versatile of all ladders - reach roof of a 3 story building

Selecting a ladder to do a specific job requires fire fighters to be a good judge of distance, stresses and strength.

Roughly speaking a building story will average 12 feet from floor to floor with a 4 foot distance from the floor to the window sill.

In general, the following table can be used for selecting ladders:

First story roof	16 to 20 feet
Second story window	20 to 28 feet
Second story roof	28 to 35 feet
Third story window or roof	35 to 50 feet
Fourth story roof	over 50 feet

G. Placing the Ladder

When placing the ladder, the angle between the ladder and the ground should be 75 degrees.

If the heel of the ladder is too close to the building, stability is reduced and the top of the ladder may be pulled away from the building during climb.

INSTRUCTORS NOTES

TEACHING POINTS

Ref; Essentials of Fire Fighting, 1st ed., IFSTA #200 p. 44

G. Placing the Ladder

If the heel is too far, it is more difficult to climb and excessive stresses are imposed on the ladder.

To determine the distance the heel of the ladder should be from the building, divide the used length of the ladder by 4.

For example: If 20 feet of a 24-foot ladder is to be used, the heel should be 5 feet (20 ÷ 4) from the building.

It is a good policy to verify the right angle of the ladder before a climb is made.

Stand erect at the bottom of a ladder and reach straight forward with the arms

If, with forward outstretched arms, the hands or finger tips pierce the ladder plane along the rungs, the ladder is spaced near the correct angle.

H. Ladder Safety Measures

When firefighters climb ladders, their safety and well-being may depend upon their careful observance of common sense precautions:

1. Examine the ladder heels to be sure they are on firm footing
2. Observe the top of the ladder to see whether it rests firmly in a proper position
3. Insure that the locks are properly seated over a rung
4. Insure that tormentor poles are properly set.
5. Anchor ladder to building using rope hose tool or have firefighter "butt" ladder

p. 46

4-9.2

The number of persons that may work from a ladder at one time must be limited to provide a margin of safety.

The loading that may be recommended takes into consideration added weight that may be induced.

A general rule-of-thumb is to space one man for every ten feet of ladder.

INSTRUCTORS NOTES	TEACHING POINTS
Ref; Essentials of Fire Fighting, 1st ed., IFSTA #200 p. 46 4-9.2	H. Ladder Safety Measures NFPA sets the maximum weight loading for different ladders, assuming proper positioning with the top against the building. Ladder-to-ground angles of less than 65 degrees require reduction in maximum loading. <u>Ladder Maximum Load Table - NFPA</u> Folding, Collapsible — 300 pounds Roof — 500 pounds Straight — 500 pounds Extension Less than 26' — 500 pounds 27-45' — 600 pounds over 45' — 700 pounds When working on a ladder the firefighters must either use a life belt or the leg-lock for their personal safety. REMEMBER to make the leg-lock opposite from the side where the work is to be performed.
p. 48 3-9.6	I. Ladder Rescue When making a rescue by ladder, raise tip to the sill below the window All other loads and activities should be removed from ladder Securely anchor ladder at top and at heel if possible Rescuing a Conscious Victim Firefighter descends below victim, keeping both arms around the body and under the armpits, with hands on the rungs in front of the victims face. One knee is placed between the victims legs to insure a support in case a rung is missed or unconsciousness occurs.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: Essentials of Fire Fighting, 1st ed., IFSTA #200 p. 48

3-9.6

An extension ladder raised with the fly sections on the outside is less likely to cause a problem for lowering the victim.

I. Ladder Rescue

An unconscious victim is similiarly held on the ladder except that the body would rest completely on the rescuer's supporting knee.

Also the victims feet are placed outside the rails to avoid any entanglement.

An alternate method of lowering an unconscious victim involves the same hold by the rescuer, except that the victim is turned around to face the rescuer.

This position also lessens the chance of the victims limbs becoming caught between the rungs.

J. GENERAL COMMENTS ABOUT RAISING GROUND EXTENSION LADDERS

Whether or not the fly section of an extension ladder should be placed next to or away from a building has bee a controversial issue for many years.

IFSTA recommends the fly section to be placed between the bed ladder and the building because this method is more consistent with the majority of state programs including WISCONSIN.

This reason alone, is however, not in itself sufficient to justify the procedure.

Some manufacturers recommend the opposite method while acknowledging the acceptability of either placement.

A decision concerning the proper technique should be made locally and it should be based upon department policies, types of ladders, ladder construction and safety features.

3-9.2
3-9.3

II. Carries and Raises - Fire Department Ladders

A. Straight Ladders

IFSTA #102 p. 47
IFSTA #200 p. 50

1. Removal from apparatus (one person)

IFSTA #102 p. 49
IFSTA #200 p. 50

2. Ladder carry (one person)

IFSTA #102 p. 50
IFSTA #200 p. 52

3. Raising (one person)

IFSTA #102 p. 53
IFSTA #200 p. 60

4. Shoulder carry (two persons)

INSTRUCTORS NOTES	TEACHING POINTS
IFSTA #102 p. 53 IFSTA #200 p. 62	5. Hip carry (two persons)
IFSTA #102 p. 54 IFSTA #200 p. 62	6. Arm's length carry (two persons)
IFSTA #102 p. 56	7. Flat raise (two persons)
IFSTA #102 p. 59	8. Beam raise (two persons)
IFSTA #102 p. 62	9. Removing extension and roof ladder from pumper (two persons)
IFTSA #102 p. 63	10. Carrying short extension with roof ladder (two persons)
IFSTA #102 p. 65	11. Short extension ladder flat raise (two persons)
IFSTA #102 p. 70	12. Short extension ladder beam raise (two persons)
IFSTA #102 p. 72	13. Carrying a roof ladder
IFSTA #102 p. 73	14. Using roof ladder with extension (two persons)
IFSTA #102 p. 79	15. Carrying short extension ladders - low shoulder method (one person)
IFSTA #102 p. 80	16. Carrying short extension ladders - high shoulder method (one person)
IFSTA #102 p. 81	17. Raising short extension ladders (one person)
	a. From-the-graound method
IFSTA #102 p. 87	b. From low shoulder carry
IFSTA #102 p. 89	c. From high shoulder carry
	18. Medium-Length Extension Ladders - Carries and Raises
IFSTA #102 p. 91	a. Removing from apparatus
IFSTA #102 p. 92	b. Shoulder carry (three persons)
IFSTA #102 p. 93	c. Arm's length carry (three persons)
IFSTA #102 p. 93	d. Three person raise

INSTRUCTORS NOTES	TEACHING POINTS
IFSTA # 102 p. 99	II. Carries and Raises - Fire Department Ladders
	19. Extension Ladders with Poles
IFSTA #102 p. 99	a. Removing from apparatus (five persons)
IFSTA #102 p. 100	b. Shoulder carry (five persons)
IFSTA #102 p. 101	c. Arm's length carry
IFSTA #102 p. 102-103	20. Preparing to Raise
IFSTA #102 p. 104-105	21. Raising
IFSTA #102 p. 110	22. Using the Attic and Baby Bangor Ladders
IFSTA #102 p. 110	a. Folding Ladders
IFSTA #102 p. 111	b. Combination extension ladders
IFSTA #102 p. 113	23. SPECIAL CARRIES, RAISES AND USES
IFSTA #102 p. 113	a. Carry for narrow space passage
IFSTA #102 p. 114	b. Moving a vertically positioned ladder
	(1) to the right
	(2) to the left
IFSTA #102 p. 117	c. Bridging with ladders
IFSTA #102 p. 118	d. Dome Raise
IFSTA #102 p. 120	e. Hotel or Factory Raise
IFSTA #102 p. 121	f. Raising ladders under overhead obstructions
IFSTA #102 p. 123	g. Hoisting ladders

UNIT QUIZ

1. State two purposes of fire service manually-operated ground ladders.

_____

_____

2. List 4 construction materials for ladders

_____

_____

_____

_____

3. List two disadvantages of aluminum ladders.

_____

_____

4. To reach a second story window, you would need a ladder of __ feet in height (circle the letter at the correct answer)

   a. 16 to 20 feet
   b. 20 to 28 feet
   c. 28 to 35 feet
   d. 35 to 50 feet

5. To reach the first story roof you would need a ladder of __ feet in height Circle the letter at the correct answer)

   a. 16 to 20 feet
   b. 20 to 28 feet
   c. 28 to 35 feet
   d. 35 to 50 feet

6. To insure the ladder is not overloaded, a rule-of-thumb is ___ person every ___ feet of ladder.

(circle the letter at the correct answer)

a. 2-12

b. 3-35

c. 1-10

d. none of the above

7. The correct angle for ladder placement is:
(Circle the letter at the correct answer)

a. 45 degrees

b. 55 degrees

c. 65 degrees

d. 75 degrees

8. If a 35-foot extension ladder is fully extended, the heel of the ladder should be spaced approximately ____ feet from the building.
(Circle letter at the correct answer)

a. 9 feet

b. 7 feet

c. 12 feet

d. 11 feet

9. To reach a fourth floor roof, you would need a ladder of __ feet in height

a. 24 feet

b. 35 feet

c. 50 feet

d. 28 feet

10. According to NFPA 1931 the maximum load permitted on an extension ladder over 45 feet in length is:

(Circle letter at the correct answer)

a. 600 pounds
b. 300 pounds
c. 500 pounds
d. 700 pounds

ANSWER KEY

1. a. save lives
   b. extinguish fires
   c. gain access to elevated areas

2. a. aluminum alloy
   b. steel alloy
   c. wood
   d. plastic or fiberglass

3. a. good conductor of electicity
   b. possibility of freezing to ladder
   c. hot is summer

4. b. 20-28 feet

5. a. 16-20 feet

6. c 1-10

7. d. 75 degrees

8. a. 9-feet

9. c. 50 feet

10. d. 700 pounds

LADDER TERMS

1. ANCHOR - that part of the ladder which is used to attach the halyard to the ladder.
2. BEAM - one of the two principal structural sides of a ladder.
3. BEAM BOLTS - bolts which pass through both rails at a truss block of a wood ladder.
4. BED - lower section of an extension ladder.
5. BRACES/STRUTTS - diagonal members between the rails and blocks.
6. BUTT - another term for the heel of the ladder.
7. DOGS - another term for ladder lock.
8. EXTENSION LADDER - a term to identify a ladder with two or more sections.
9. FLY - the upper section or top sections of an extension ladder.
10. GROUND LADDER - a descriptive term to designate the difference between ladders raised on the ground and those raised from apparatus.
11. GUIDES - wood or metal strips on an extension ladder which guide the fly section while being raised. (sometimes in the form of slots or channels)
12. HALYARD - a rope for hoisting fly section.
13. HEEL - bottom or ground end of ladder.
14. HEEL PLATES - metal safety plates attached to the heel of the ground ladder to stabilize the ladder and protect the beam.
15. HOOKS - curved sharp metal device (two in number) which folds outward from each beam at the top end of the roof ladder.
16. LOCK - metal devices used to hold the fly section in place after it has been extended.
17. PAWL - another term for a ladder lock.
18. PROTECTION PLATES - plates fastened to a ladder to prevent wear at points where it comes in contact with mounting brackets.
19. PULLEY - a small grooved wheel through which the halyard is drawn.
20. RAILS - the two lengthwise members of a trussed ladder beam which are separated by truss or separation blocks.
21. RUNGS - cross members (usually round) between the beams on which people climb.

LADDER TERMS

22. SAFETY SHOES - rubber or neoprene spike plates usaully of the swivel type, attached to the heel of the ground ladder.

23. SPURS - metal points at the lower ends of tormentor poles.

24. STAYPOLE - another term for tormentor.

25. STOPS - wood or metal pieces which prevent the fly section from being extended too far.

26. STRAIGHT LADDER - term used to identify a ladder of one section.

27. TIE RODS - metal rods running from one beam to another.

28. TOGGLE - a device by which a tormentor pole is attached to a ladder.

29. TOP OR TIP - the extreme top of the ladder.

30. TORMENTOR POLES - the poles which are attached to long extension ladders.

31. TRUSS - an assembly of beam members so combined as to form a rigid framework.

32. TRUSS BLOCK - separation pieces between the rails of a trussed ladder. Sometimes used to support rungs.

LADDER TYPES

1. Straight Ladder

   a. nonadjustable in length - one section

   b. size designated by overall length of side rails - generally 12 - 14 - 16 - 18 and 24 feet, although longer straight ladders do exist.

   c. sometimes called a "wall ladder".

   d. straight ladders must be constructed to have a maximum strength and minimum weight and may be of the trussed type to reduce their weight.

2. Extension Ladder

   a. adjustable in length - consists of two or more sections which travel in guides or brackets to permit length adjustments.

   b. size designated by the lengths of the sections measured along the side rails when fully extended. Range from 24 to 55 feet in length.

   c. Most of longer extension ladders are truss type, and are usually equipped with stabilizing poles called tormentors.

   d. heavier than straight ladders - required more personnel to raise.

   e. Baby Extension (Baby Bangor)

      (1) 12 foot long extension ladder without a halyard to raise the fly section - hand raised fly is held in position by engaging its heel spurs over the upper rungs of the main section.

3. Combination Ladders

   a. is adjustable in length and the sections can be unlocked to form a stepladder or "A" fram ladder.

   b. size designated by length of sections.

4. Roof Ladders

   a. designated for one specific purpose - can be and has been used for other purposes.

   b. equipped with folding hooks which fasten over roof ridge or other parts with the ladder laying flat on roof.

   c. range from 12 to 20 feet in size.

LADDER TYPES

5. Folding Ladders

   a. used for reaching through openings into attics and lofts.

   b. constructed so that they can be folded or collapsed for small room or closet work.

   c. generally short in length as they are only used to reach short distances.

6. Aerial Ladders

   a. mechanical unit generally operated by hydraulic power - mounted upon a specially built chassis.

   b. currently constructed of metal, trussed to provide adequate strength and usually 65 - 100 feet in length although larger ladders exist.

7. Tower Ladder

   a. a telescoping boom with a ladder mounted on it and a partially enclosed platform at the end of the tower.

8. Elevating Platforms

   a. Although elevating Platforms are not considered ladders some do carry ground ladders.

   b. primarily a portable elevator controlled by the operator.

   c. range from 50 - 135 feet in height with some larger units being constructed.

9. Pompier Ladder

   a. single beam through which the rungs project with a gooseneck hook on the end.

   b. used to rescue persons beyond the reach of ground or areial ladders.

   c. seldom used or carried today.

LADDER SAFETY MEASURES

When firefighters climb ladders, their safety and well-being may depend upon their careful observance of common sense precautions:

1. Examine the ladder heels to be sure they are on firm footing.

2. Observe the top of the ladder to see whether it rests firmly in the proper position.

3. Insure that the locks are properly seated over a rung.

4. Insure that tormentor poles are properly set.

5. Nachor ladder to building using rope hose tool or have firefighter "BUTT" ladder.

6. A general rule-of-thumb is to space one person for every ten feet of ladder.

LADDER MAXIMUM LOAD TABLE - NFPA

Folding collapsible	300 pounds
Roof	500 pounds
Straight	500 pounds
Extension	
Less than 26'	500 pounds
27-45'	600 pounds
Over 45'	700 pounds

When working on a ladder the firefighter must use either a life belt or the leg lock for their personal safety.

REMEMBER: to make the leg lock opposite from the side where the work is to be performed.